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ABSTRACT

A study was made of similarities and differences in parent-child interaction in two contexts: a book-reading activity and a home computer activity involving an alphabet program. A total of 20 children 3 years of age and their parents (10 children with mothers, 10 with fathers) were videotaped in two 12-minute sessions of each activity. A variety of verbal and behavioral measures revealed a number of differences in participants' interactions with the two media. Book reading elicited more verbalization overall and was more exclusively tutorial with respect to naming things. Computer interactions featured more comments about things, parental directives about how to operate the computer, and questions from the children. More similarities than differences were found in the behavior of mothers and fathers; however, mothers were remarkably consistent in their interaction across the two tasks and fathers were not. Discussion of findings focus on media effects, parental effects, and the relevance of findings for the design of computer prereading activities for children. (Author/RH)

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Preschoolers' alphabet learning activities with their parents: Picture-books vs. personal computer software

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Abstract

How does parent-child interaction with a computer alphabet program compare with reading a picture book? Our study compared the traditional medium of book reading with a new educational tool, the home computer. Twenty 3-year-olds and their parents (10 children with their mothers and 10 with their fathers) were videotaped in two 12 minute sessions reading picture books and interacting with alphabet-learning software on a personal computer. A variety of verbal and behavioral measures revealed a number of differences in participants' interactions with the two media. Book reading elicited more verbalization overall and was more exclusively tutorial in naming things. Computer interactions featured more comments about things, parental directives about how to operate the computer and more questions from the children. There were more similarities than differences between mothers and fathers, except that mothers were remarkably consistent across the two tasks and fathers were not. The discussion focuses on media effects, parental effects, and the relevance of our findings for the design of computer prereading activities for children.

Preschoolers' alphabet learning activities with their parents: Picture-books vs. personal computer software

Before children begin school, they frequently participate in informal learning activities with others. Over the last 25 years, emphasis has been placed on examining the parent-child dyad in such informal learning experiences. Pioneering studies (Bee, Van Egeren, Streissguth, Nyman, & Leckie, 1969; Brophy, 1970; Hess & Shipman, 1965) examined the teaching strategies of mothers from different socioeconomic groups. Recent researchers (Frankel & Rollins, 1983; Golinkoff & Ames, 1979; Sigel, 1982) have looked at differences (and similarities) in the interaction styles of mothers vs. fathers. Results from these studies are directly pertinent to understanding the antecedents of educational achievement during the school years because early parent-child interactions play an important role in a child's preparation for success in the traditional schooling environment. In the present study we investigated how preschoolers and their parents interact with a new educational tool, the personal computer. In addition, because of the lack of prior research in this area, provision was made to assess parent-child computer interaction with reference to a well-understood comparison activity, joint picture-book reading.

Because learning the alphabet is one of the most important accomplishments of the preschool years (Price, 1984), the alphabet was featured in both the parent-child book reading and the computer activity investigated. Traditionally, preschoolers gain experience with the letters of the alphabet in interactions with family members, from children's TV, in nursery school, in playing with certain toys (i.e., alphabet blocks), and from alphabet books (read alone, or jointly with others). It is widely reported that children's

access to reading and writing materials (e.g., picture dictionaries, alphabet books, basal readers, paper, pencils, blackboards) is related to early school achievement, especially in the area of reading (see Hess, Holloway, Price, & Dickson, 1982, for a review). The personal computer offers a potentially significant new medium for learning the alphabet, particularly in the informal family environment. Surveys show that 16% of the families in America own a home computer (Kalette, 1984). Middle-class American families appear to view the personal computer as a valuable additional ingredient in the home educational environment. Moreover, it is reported (Talmis, Inc., 1984) that at least one third of the educational software purchased is targeted for children under the age of 7. The program used in this study, "My First Alphabet," marketed by Atari, is an example of such software.

How does parent-child interaction with such a computer program compare with the more traditional and familiar activity of reading an alphabet book? While virtually no previous research exists on computer use by preschoolers and their parents, there are several relevant studies of parent-child picture-book reading (Guinagh & Jester, 1972; DeLoache 1983, Ninio, 1980; 1983; Ninio & Bruner, 1978; Snow & Goldfield, 1983). From these studies we know that joint picture-book reading is an ideal routine for instruction in naming things. Indeed, mothers are much more likely to label objects pictured in books than objects in the real world (Ninio & Bruner, 1978). Because the book constrains potential utterances to some degree, the mother's utterances are predictable and recurrent (Snow & Goldfield, 1983). In their earliest reading sessions mothers model a routine for requesting and giving identifications, and as children develop they are gradually encouraged to increase their level of collaboration in these labeling routines. Mothers keep track of their child's vocabulary and gradually shift responsibility for

naming things from themselves to the child (DeLoache, 1983). With three-year-olds, mothers begin to expand upon the information-gathering routines; they question information and elaborate upon it in routines designed to foster comprehension as well as labeling. These routines for gathering and exchanging information from picture-books provide the child with early training for the kind of dialogue they will encounter in the formal educational setting (Brown & Purcell, 1984).

The content presented in alphabet books and by the computer is fairly similar, consisting of a target letter associated with an object or animal, and perhaps a word or two that begin with the letter. The essential differences, then, are a matter of presentation format rather than content. Thus even though they present similar content, the two media potentially provide environments hospitable to different patterns of interaction. In the computer software examined in this study, the child (or parent) pushes a key on the keyboard. A colored graphic design is drawn showing an object or animal, the letter selected, three other words, and a little man who runs back and forth across the bottom of the screen. When the design is complete (this takes 15 to 30 seconds), a short musical passage is played. Thus, the computer is "active" in the sense that it develops the visual input, and determines the timing of letter episodes. We thought that participants might use the time after each key press to discuss various hypotheses about what the computer was creating. The book, in contrast, requires that participants direct their own attention to immediately available pictures, via pointing or labeling, and the timing of letter episodes is self-determined.

Additional questions addressed in this study included whether other aspects of the language behavior of the parents and children would differ in the two settings. Would the computer hold the child's attention as well as

(or perhaps even better than) the book? Would the parent direct the child's attention more actively or specifically in one setting vs. the other? Does the pace of the interaction differ as a function of medium? Notice that these questions focus upon the nature of parent-child interactions with the two media, rather than the amount of learning resulting from such experience. Our study, therefore, provides a detailed account of parent-child interactions, particularly with the new medium of the personal computer, rather than the assessment of short-term outcomes.

Existing studies of picture-book reading with preschoolers have examined mothers. Thus, in our study provision was made to compare mothers with fathers. This comparison will serve to extend existing research concerning joint picture-book reading to fathers and provide an opportunity to evaluate anticipated task influences on the consistency of mothers' vs. fathers' teaching styles. Numerous studies have compared mothers' vs. fathers' interactions with their preschool children, but in non-picture-book tasks. Generally speaking, results from these studies suggest more similarities than differences in mothers' and fathers' interactions across a variety of tasks and situations (see Frankel & Rollins, 1983; Golnikoff & Ames, 1979; Pakizegi, 1978). Only a few studies have suggested systematic differences between parents. For example, Sigel (1982) reports that across tasks (story telling vs. origami paper folding) mothers were more consistent in their emotional tone to their four-year-olds, whereas fathers tended to use a more consistent form and content when conveying information in the two tasks.

By far the most dramatic differences between fathers and mothers were found by Masur and Gleason (1980), who studied the way parents and 3-year-olds played with a large toy car. They found marked differences in the way mothers and fathers produced and elicited lexical information. Fathers both requested

and provided more lexical terms, and they were more likely to describe the functions of the various car parts, thus extending and elaborating their children's lexical knowledge. Whereas mothers provided labels mainly when a lack of knowledge was indicated by the child, fathers tended to test, confirm, and elicit displays of knowledge that their child already possessed. Perhaps because of this difference, children showed higher and more uniform levels of lexical production to fathers than to mothers. Masur and Gleason speculated that these advantages for fathers may have been due to the traditionally masculine domain of the automobile.

Thus, because differences in parents' interaction styles seem to depend upon the task, we anticipated possible differences between mothers and fathers when book reading was compared with a computer activity. Whereas early picture-book reading is done primarily by mothers (Laosa, 1982), it is reported that fathers are more likely to purchase and use personal computers in the home (Miura & Hess, 1983). Mothers, therefore, were expected to be more proficient at book reading, as manifested in interchanges that are more directly focused upon the naming and labeling of items in the books. Following Masur and Gleason's (1980) speculations about traditionally "masculine" activities, fathers were expected to express different behaviors than mothers in the computer task, perhaps because they are more comfortable with this new medium.

In our study twenty preschoolers and their parents were videotaped in 12 minute sessions. Three year olds were selected because (a) this is the prime age for alphabet learning, and (b) we wished to test the youngest children who could interact appropriately and easily with the computer. Subjects participated in both book reading and computer sessions, to insure that any differences found were due to the media rather than subject characteristics

(order was counterbalanced). Three alphabet books were selected on the basis of the simplicity of their pictures and their inherent interest to preschoolers (tested informally with pilot subjects). In order to permit a within-subjects design, we decided against constructing a content-equivalent book by photographing the computer screen for each letter (other reasons included the desire to preserve ecological validity by using materials typically available in the home, and the fact that pilot testing had shown that participants would probably peruse more than one book per 12-minute session anyway). A variety of verbal and behavioral measures were taken in order to provide a detailed characterization of differences and similarities in parent-child interactions with the two media.

Method

Subjects. Subjects were ten girls and ten boys between the ages of 3 and 4 years (M = 3.5 years), recruited from local preschools. Half participated with their mothers, and half with their fathers. Twelve of the children had had some experience with video games. Seven of the girls could name at least half of the letters of the alphabet, when presented with a randomized recognition test; only two of the boys knew their alphabet. Thus the average number of letters recognized by girls (M = 14.6) significantly exceeded that of the boys (M = 4.0), F (1,16) = 9.60, $p < .01$. This suggests that the girls may have had an advantage in verbal experience or ability. For this reason sex was included as a factor in analyses of the children's data. As it turned out, however, sex of child effects were few and minor in character, compared to the main variables of interest.

Apparatus. An Atari 800 microcomputer, disc drive, and color monitor were used to run the "My First Alphabet" software. Three simple alphabet books appropriate for this age range (Allen, 1980; Eastman, 1974; Williams, 1957)

were employed in the book reading condition. Videotaping used portable videotape recording equipment, camera, and monitor. Sound recording was accomplished using a wireless microphone and a receiver attached to a cassette recorder.

Design and procedure. The study was based on a 2 (sex of parent) x 2 (sex of child) x 2 (task) mixed factorial design, with the book vs. computer task as a within-subjects variable. The order of activities was reversed for half of the subjects.

Children and parents came to the observation room and spent a few minutes getting acquainted with the laboratory setting. During this time the number of letters the child could correctly identify was assessed with a recognition test. Then (for the computer-first subjects) the parent and child were seated on the couch in front of the computer. The wireless microphone was attached to the parent's lapel, and they were given basic instructions in how to operate the computer. The program is so simple that all the child has to do is push a key and watch what happens. After the parent and child were video and audio taped for 12 minutes, a break allowed the child some physical activity. The experimenter removed the computer apparatus during this time. The parent and child then returned to the couch for a 12 minute book reading session. All three books were available to choose from and instructions in this condition were brief and unstructured, e.g., "Please read this alphabet book to your child as you would at home."

Results and Discussion

For all results reported, except where noted, the findings were significant at the $p < .05$ level. Newman-Keuls tests were used for all post-hoc comparisons unless otherwise specified. Analyses of the participants' verbalizations are presented first, followed by analyses of

physical behaviors.

Preliminary Analyses of Verbalizations

The first set of analyses were designed to address simple descriptive questions. How much talking was there by the various actors in the two situations? How much material was covered? Audio recordings were transcribed and the transcriptions were corrected by a second observer. Utterance boundaries were determined on the basis of syntax and intonation contours, following Masur (1982). Each measure was analyzed in a sex of parent x sex of child x task mixed analysis of variance, with task as the repeated measure. Girls and boys did not differ in their level of linguistic complexity (M MLU = 2.84), nor did this differ for book reading vs. computer interaction. In fact, none of the preliminary analyses revealed main effects of sex of parent or of child, nor were there any sex x task interactions.

Main effects of task in several analyses, however, showed book reading to be the more efficient activity in terms of amount of material covered. For example, the number of turns (defined as a change of speaker) per 12 minute sample was a rough measure of overall verbal interaction. Parents and children took significantly more turns when book reading (M = 121.15) than in the computer activity (M = 86.75), F (1,16) = 29.74. Moreover, the total number of letters discussed in the book reading task (M = 40.5) was more than double the number of letters discussed in the computer situation (M = 19.5), F (1,16) = 60.63. In addition, the number of letters repeated (either by reviewing previously read sections of a given book, reading another book, or selecting the same computer key more than once) was more than five times as great in the book task (M = 18.15) than in the computer task (M = 3.35), F (1,16) = 32.95. This was undoubtedly a result of the self-paced nature of book reading. Whereas the computer took an average of 25.15 sec to present

each letter, book readers preferred to explore letters at a rate more than twice that fast.

Conversational cycles were defined as two or more turns during which a single topic was discussed. Parents initiated significantly more cycles (M = 21.88 conversational cycles per 12-minute session) than children (M = 9.88 cycles initiated), F (1,38) = 24.29. Parents also terminated cycles on most occasions (72% of the time); this propensity for parents to have the last word on a given topic did not vary for mothers vs. fathers. The task influenced both the number and the length of cycles. An average of 21.82 cycles were initiated when book reading, but parents and children averaged only 9.92 cycles in the computer activity, $F(1,38) = 29.65$. However, cycles of conversation with the computer were significantly longer (M = 5.43) than during book reading (M = 3.44), $F(1,36) = 14.84$. Thus, although there was less overall conversation during the computer activity, the slower pace of presentation resulted in longer conversations about particular topics.

Verbal events

The next set of analyses concerned the content of the speech directed from the parent to the child (and vice versa) in the two settings. The purpose of these analyses was to provide a more qualitative characterization of the differences and similarities in the participants' verbal activity in the two tasks. A preliminary review of the transcripts showed that all of the verbal events could be categorized into ten classes, described in Table 1. These categories represented four general kinds of messages, ranging from a specific focus upon naming and labeling (identifications and requests for identification), to elaboration and comprehension-fostering (comments, questions, and extraneous references), to feedback (positive, negative remarks), to attention-getting or exclamatory devices (directives, use of name

or other personal reference, laughter). Of the forty protocols for the parents (twenty each in the book and computer conditions), ten were selected at random to be coded independently by two experimenters, yielding an average inter-rater reliability (IRR) of .98. Eleven of the children's protocols were also coded twice, with mean IRR of .94. The remaining transcripts were coded by one of these two raters.

Insert Table 1 about here

An initial informal comparison found that, overall, parents talked more, averaging 222.22 verbal events per 12-minute sample, compared to 128.65 for the children. Moreover, in agreement with the preliminary data reported above, both parents and children talked more in the book task (parents' $\underline{M}$ = 244.95, children's $\underline{M}$ = 151.20) than in the computer activity (parents' $\underline{M}$ = 199.50, children's $\underline{M}$ = 106.10), $\underline{F}$s (1,16) = 28.65 and 32.95, for parents and children, respectively. Because of these differences in sheer "talkativeness" by parents and children in the two tasks, subsequent analyses examined the proportion of the total number of verbal events for each task (and the results were quite similar to those found when frequencies, rather than proportions, were analyzed). This gives a more qualitative comparison of the distribution of verbal events into the various categories in spite of different base rates of verbalization. Parents' and children's utterances were analyzed separately because of nonindependence (verbal events produced by one person influence the responses given by the other).

The results for the parents were analyzed using a 2 (sex of parent) x 2 (sex of child) x 2 (tasks) x 10 (categories) mixed analysis of variance with tasks and categories as repeated measures, and proportion of verbal events per

task as the dependent measure. There was, of course, no main effect of task because in this analysis the data were conditionalized on overall task performance. There was a significant main effect of category, as can be seen in Table 2, F (9,144) = 45.17. As the pattern of subscripts in Table 2 shows, the parents' verbal events were distributed differently into the various categories, but these differences were gradual rather than sharp (in contrast to the children's data to be presented next). Moreover, there was also a significant interaction of task by category type, F (9,144) = 13.38. This interaction was evaluated by performing a series of correlated t tests comparing the book vs. computer task for each of the category types. The results showed that the parents' verbal events differed significantly in four categories. In the book reading task, parents made a significantly greater proportion of identifications, $t(19) = 4.70$, and made significantly more extraneous references, $t(19) = 2.46$. In the computer game, parents gave significantly more directives, $t(19) = -7.39$, and made a significantly greater proportion of comments, $t(19) = -2.55$. There were no main effects nor interactions associated with the sex of parent or sex of child.

Insert Table 2 about here

For children, a parallel analysis showed that the verbal categories also differed significantly from one another, F (9,144) = 150.36. As shown in Table 3, identifications greatly (and significantly) exceeded all other verbal events. Comments were next highest proportion, and comments also significantly exceeded all other categories, none of which differed from one another. A significant task by categories interaction was also found, F (9,144) = 2.85, and most important, there was a task x category x parent

triple interaction, F (9,144) = 4.00, as also shown in Table 3. Simple interaction effects analyses for each category type located a number of task x parent interactions that closely approached significance (all $ps < .06$); because of our apriori expectations of parent-task interactions, we analyzed these further to identify the particular significant contrasts. (1) Children gave a significantly greater proportion of identifications to their mothers in the book than in the computer task, correlated $t(9) = 2.85$. (2) Children made a significantly greater proportion of comments to their mothers in the computer game than while book reading, $t(9) = -3.11$. (3) Children asked a significantly greater proportion of questions of their mothers during the computer activity, $t(9) = -2.51$. In contrast, identifications, comments and questions did not differ for the two tasks when children interacted with their fathers. (4) Finally, the rare event (for children) of requesting identifications from their parents yielded a significant parent x task interaction, $F(1,18) = 6.50$. This interaction was due to a cross-over pattern where children made more requests to their mothers in the book task, and more requests to their fathers in the computer activity, but these individual comparisons were not significant in the post hoc tests.

Insert Table 3 about here

Recall that Sigel (1982) reported stylistic differences for mothers and fathers across tasks. Thus an additional analysis evaluated the consistency of parents' and children's verbal style in the two situations studied here. Table 4 shows the correlations between the two tasks for each of the ten verbal categories. Mothers used a highly consistent verbal style in both tasks. Seven of the ten categories showed high and significant correlations,

and one additional category (requests for identification) approached significance as well. Only in their use of their child's name and when making positive remarks were mothers not significantly consistent across the two tasks. Fathers, in contrast, were only consistent in their requests for and provision of identification, and laughter. Seven out of ten verbal categories for fathers were not significantly correlated in the two activities. Similarly, children were notably inconsistent from task to task, except for laughter, and use of their mothers' name.

Insert Table 4 about here

Summary. There were marked differences in verbalization rates of parents and children, and book reading elicited dramatically more verbalization than the computer activity. Because of these baseline differences, the data were tranformed to proportions of overall verbal behavior. Parents and children showed strikingly different patterns of distribution of their categories of verbal expression. Parents used a variety of verbal messages, although they spent most of their time making requests for and giving identifications, and to a lesser degree, making comments and positive remarks. Directives and questions were less frequent, and negative remarks, extraneous references, laughter and use of the child's name were rare events for parents. The children's profile, in contrast, revealed predominant use of only two verbal categories: identifications and (to a lesser extent) comments.

Finer-grained analyses showed that parents varied their messages as a function of task. They used book reading as a particular opportunity to label pictures, as shown in their higher proportion of identifications. The computer activity, in contrast, prompted higher use of directives and more

comments about things (rather than labeling per se). Mothers and fathers exhibited this strategy shift to the same degree, a finding in agreement with previous studies suggesting that task effects outweigh mother-father differences in teaching strategies (Frankel & Rollins, 1983; Sigel, 1982). However, the similarity in the way mothers and fathers as a group showed task-related variation in their teaching strategies could be contrasted with the dramatic difference in the consistency of verbal style between mothers, fathers, and children. As individuals, mothers were remarkably consistent across most categories in verbal style, while fathers were only consistent in their use of the two most directly instructional categories, identifications and requests for identifications. Their use of elaborative and comprehension-fostering messages, feedback, and attention-getting devices varied from task to task. Children were even more task-variable.

Nevertheless, children shifted their verbal focus to a greater proportion of identifications while book reading (at the same time reducing their proportion of comments and questions), but only when reading with their mothers. Thus, although fathers and mothers did not show any differential variation in their patterns of verbal behavior in the two tasks, children exhibited task sensitivity only when working with their mothers. Mothers differed dramatically from fathers in stylistic consistency, and the correlational results suggest that individual mothers invoked familiar and well-practiced routines for teaching in both tasks. As they increased their relative proportion of labeling messages when book reading, children followed suit by increasing their proportion of identifications. In the computer task, the mothers' increase in the more elaborative category of comments was mirrored by children as well. Fathers also switched strategies, but perhaps because their individual verbal styles were so inconsistent from task to task,

children as a group were not likely to alter their verbalizations in concert with their fathers' adjustments.

Verbal Response Patterns

Additional evidence concerning the nature of parental teaching strategies is provided by analysis of conditional responses, that is, the degree to which one speaker's verbalizations depended upon the other speaker's previous utterance. Therefore, the protocols were analyzed for five types of conditional responses. Given a particular initiating event (e.g., parent requests an identification) we computed the proportion of the time a particular response occurred as the next verbal event (e.g., child gives correct identification, incorrect identification, or ignores the request). Previous research has shown that lag-one conditional probabilities capture almost all the information in such analyses (Martin, Maccoby, Baran, & Jacklin, 1981). Each of the analyses used a sex of parent x task x response category mixed analysis of variance, with task and response as repeated measures. Separate analyses were conducted for parents and children. In each case the children's results will be reviewed first.

Identifications. When parents requested an identification, children gave the correct label 47% of the time, ignored the request 32% of the time, and gave an incorrect response 32% of the time, $F(2,36) = 10.64$. Correct responses differed significantly from incorrect responses; ignoring responses were intermediate. In contrast, parents never responded incorrectly to a child's request for an identification, but instead were equally likely to give the correct label (48%) as to ignore their child's request (52%), $F(1,18) < 1$.

Responses to identifications. When a parent gave an identification, children were significantly more likely to ignore it (58%) than to confirm it by repeating the label or giving positive feedback (39%) than to correct it

(4%), $F(2,36) = 73.62$, all contrasts significantly different. When a child made an identification, parents were significantly more likely to give confirmations (53%), compared with corrections (25%) and ignoring (22%) responses, $F(2,36) = 35.55$. This interacted with task, $F(2,36) = 4.59$, such that confirmations were significantly higher (57%) in the book task than in the computer game (48%), correlated $t(19) = 2.18$, and ignoring responses were higher in the computer task (27%) than in the book task (17%), $t(19) = -2.36$. Corrections did not vary as a function of task.

Responses to questions. Children's responses to questions varied significantly overall, $F(2,36) = 38.32$, as a function of response type x task, $F(2,36) = 5.29$, and as a function of response type x task x parent, $F(2,36) = 3.69$. This interaction showed that when children interacted with the computer with their mothers, their proportion of correct answers to questions (32%), incorrect responses (22%) and ignoring of questions (46%) did not differ significantly. When reading books with their mothers, in contrast, children were significantly more likely to ignore questions (56%) than to give correct (33%) or incorrect (12%) answers, $F(2,18) = 12.08$. This tendency to ignore questions when book reading was especially pronounced for children reading with their fathers (74%); ignoring significantly exceeded correct (20%) and incorrect (6%) answers, $F(2,18) = 35.46$. In contrast, when children interacted with the computer with their fathers correct answers (51%) and ignoring responses (48%) did not differ, but both exceeded incorrect answers (.5%), $F(2,18) = 15.71$. Children hardly ever employed rhetorical questions (providing their own answers); this device was used an average of only .41 times per session by the children. Parents' responses to questions varied overall, $F(2,36) = 38.16$, and this interacted with task as well, $F(2,36) = 3.70$. When book reading parents were as likely to answer correctly (55%) as

to ignore questions (36%), but both responses significantly exceeded wrong answers (8%), $F(2,36) = 8.50$. When interacting with the computer, correct answers (73%) significantly exceeded ignoring (20%) and wrong answers (7%), $F(2,36) = 2.44$. Finally, parents often answered their own rhetorical questions, using this teaching device an average of 4.78 times per reading or computer session.

Responses to comments. Whenever a parent made a comment, the child was significantly more likely to ignore it (72%) than to respond with an appropriate reply (28%), $F(1,18) = 42.28$. Parents showed the opposite pattern, responding appropriately to their children's comments (70%) significantly more often than ignoring them (30%), $F(1,18) = 27.60$.

Responses to directives. Finally, for the category of directives, children obeyed directives 82% of the time and failed to obey them 18% of the time, $F(1,18) = 95.24$. Parents obeyed their children's directives more often (68%) than not (32%), $F(1,18) = 9.90$, but this interacted with task ($F(1,18) = 6.90$) such that parental compliance with directives was only significantly greater (77% compliance, 33% noncompliance) in the computer task, $t(19) = 4.98$. Parents were as likely to ignore their children's directives as to honor them when book reading.

Thus, in general, the parents' response patterns exhibited many properties associated with direct teaching. Parents either gave correct identifications or ignored requests, but never gave incorrect identifications. They regularly confirmed their children's identifications, especially when book reading (whereas children's identifications were more likely to be ignored in the computer situation). Parents were highly likely to respond to their children's comments (this was a manifestation of the "last word" phenomenon described in the cycles data). When interacting with the computer, parents

answered 73% of their children's questions correctly; in book reading questions were either answered correctly or ignored (perhaps because parents were focusing so directly on labeling the pictures). Parents obeyed the majority of their children's directives, but only in the computer situation; children were less "in charge" when book reading. Children played the role of "student" in these interchanges; they gave correct identifications when requested, but tended not to confirm their parents identifications, nor to reply to their parents' comments. They faithfully obeyed their parents directives. The only incongruous result concerned children's responses to questions; children hardly ever responded to questions incorrectly, but instead tended to ignore questions, particularly when reading books with their fathers. This interaction of parent x task for children's answers to questions was the only effect associated with sex of parent. This result suggests that fathers' questions may have been somehow inappropriate for the child's knowledge or cognitive development, and thus children ignored them, but there is no ready explanation for why this should especially occur when book reading.

Behavioral Events

The frequency and duration of various behavioral events were tallied from the videotapes to assess the degree of interest and involvement on the part of parents and children in the book vs. computer setting. A timing and counting program run on the Atari microcomputer was used for this analysis. Both parent and child behaviors were tallied by two independent observers, and the average correlation between the two raters for the duration of behavioral events was $r = .93$; for frequency it was $r = .90$. Initial analyses examined whether behavior varied across three four-minute time intervals, as a function of sex of parent, or sex of child. These factors were not significant for

most dependent measures (an exception to this is reported for the behavior of looking away). Thus the analyses to be reported used an actor (parent vs. child) vs. task (book vs. computer) mixed design.

Looking. Participants' relative interest in the two tasks was reflected in their looking patterns. The direction of looking can be characterized as either on-task (looking directly at the book or at the computer), task related (looking at the other person), or off-task (looking away). Using these categories, we were able to account for the participants' looking direction over 95% of the time. As Table 5 shows, the vast majority of looking behavior was directly on-task or focused on task-related targets.

Insert Table 5 about here

Participants looked directly at the book longer (M = 547.23 sec.) than they looked at the computer screen (M = 458.94 sec.), F (1,38) = 28.67. However, this advantage for book reading seems to have been due to the necessity to look at the computer keyboard in order to activate the next scene on the computer screen. When the looking time for the screen plus keyboard was compared to time spent looking at the book, the computer (M = 616.63 sec.) was looked at significantly longer than the book (M = 547.23), F (1,38) = 26.71. As for task-related looking behavior, book readers spent significantly more time looking at each other (M = 96.32) than when they interacted with the computer (M = 44.62 sec.), F (1,38) = 54.06. Moreover, a main effect of actor showed that it was parents who spent most of the time looking at the children (M = 124.64 sec.); children only looked at their parents an average of 16.30 sec., F (1,38) = 28.67. Although the off-task behavior of looking away was a rare event, the amount of time was many times greater for children (M = 74.00

sec.) than for parents (M = 9.21 sec.), F (1,38) = 24.37. Moreover, the children's distraction increased significantly over time, with looking away in the first (M = 19.84 sec.) and second (M = 23.26 sec.) four-minute segments significantly less than in the last segment (M = 30.90 sec.), F (2,32) = 3.49. However, this trend toward children's greater distraction later in the session did not vary as a function of task. Overall, looking away was greater during book reading (M = 57.82 sec.) than during the computer activity (M = 25.39 sec.), F (1,38) = 16.02.

These results for looking show that both tasks were remarkably engaging for parents and children alike. When book reading, participants spent the vast majority of the time looking directly at the book. In addition, they spent a modest amount of time looking at each other while discussing particular letters or pictures (and it was parents who particularly tended to glance at their children). Less than 10% of the time was spent looking away from the reading task. However, the computer activity was even more engaging, as participants spent nearly 90% of their time looking directly at the screen or at the keyboard! As a result, they spent even less time looking at each other or away than when book reading. In this respect, then, the computer lived up to its reputation for capturing attention; it proved superior to the highly involving activity of book reading, and was equally compelling for adults and for three-year-olds, in spite of the children's allegedly short attention spans.

Pointing. Physical attention-directing activity is reflected by an analysis of pointing responses. Parents spent significantly more time pointing (M = 96.68 sec.) than did children (M = 46.94 sec.), F (1,38) = 8.40. Both adults and children pointed significantly longer at the book (M = 123.63 sec.) than at the computer screen (M = 19.99), F (1,38) = 46.12. Finally,

when a significant interaction of actor and task (F (1,38) = 8.05) was further evaluated for simple main effects of actor within each task, book reading was found to elicit dramatically more pointing time by parents (M = 170.14 sec.) than children (M = 77.12 sec.), F (1,38) = 8.80, whereas parents and children pointed at the computer for equal lengths of time.

Manipulation. The amount of physical manipulation was defined as frequency of page turning in the book task, and frequency of manipulating the computer keyboard. These are not directly comparable, since while each keypress caused the computer to display one letter, a page turn was likely to reveal several new letters simultaneously. Accordingly, separate analyses were conducted. For page turning, children turned pages significantly more often (M = 27.20 turns) than parents (M = 14.90), F (1,38) = 4.54. Similar findings were obtained in the computer task, in which children's activity (M = 33.57) significantly exceeded that of parents (M = 9.82), F (1,38) = 80.73.

Thus, children were in charge of "operating" both the book and the computer. They turned more pages and pressed more keys than their parents. As for the attention-directing activity of pointing, this was used much less frequently in the computer activity than during book reading. Parents, in particular, pointed a great deal at the book, pointing for nearly 1/4 of the entire twelve-minute reading session!

Conclusions

Media differences. In spite of similar contents, the different presentation formats of alphabet books and alphabet software elicited a number of important differences in the way parents interacted with their preschoolers. Book reading elicited both more interaction overall and a qualitatively different kind of interaction than did the computer activity. More letters were reviewed, more of them were repeated, and the total amount

of conversation was much greater in the book task. This may have been because subjects chose to read the alphabet books faster than the rate at which the computer was programmed to present the alphabet exemplars. Rather than filling the time after a keypress with discussion of various hypotheses for what the computer would draw, participants typically gazed at the computer screen in awed silence until the picture was finished. Book reading was particularly characterized by a greater proportion of identifications than the computer task, a finding that extends the previous report by Ninio and Bruner (1978) that mothers label objects and pictures in books more frequently than they name real objects. In our study book reading was associated with more labeling than a computer activity designed to teach the alphabet, and this effect held for fathers as well as for mothers. In both activities parents assumed a teaching role, but parents were especially prone to confirm and reinforce their children's identifications when book reading. Because these results were equated for overall differences in production, they could not be a spurious result of the relatively slow pace of the computer game, which provided fewer examples to talk about than the book-reading task. Thus book reading is particularly conducive to instruction in naming things, as previously suggested by Snow and Goldfield (1983).

The participants' behaviors varied in the two tasks as well. Whereas both media were highly visually engaging, the computerized alphabet presentation was superior to the book, capturing visual attention over 90% of the time. This may be due to both the active nature of its presentation and the relative novelty of the format. Perhaps as a consequence, directing attention via pointing was used significantly less in the computer task. Indeed, participants compensated for the inactive nature of the book by pointing at the book over 10 times longer than at the computer screen. Parents in

particular used pointing to direct the child's attention to pictures in the books; they pointed for nearly 3 of the 12 minutes. The one behavioral area in which the media did not produce differences was physical manipulation; children were given primary responsibility by their parents for both key pressing and page turning.

Parents' verbalizations were more affected by the different tasks than were those of the children. Parents spoke a great deal more and produced a greater variety of messages than did children, who mostly identified items, and (to a lesser extent) made comments. Parents shifted from a predominance of identifications and requests for identifications in the book task to an increased proportion of comments and directives in the computer task. For children, identifications were the chief verbal behavior in both tasks, with comments at a relatively high level as well, and a minimum proportion of other verbal messages. Children shifted to a higher proportion of identifications when book reading, and increased their proportion of comments and questions during the computer game, but only when interacting with their mothers. Thus children's sensitivity to differences in the two media did not generalize across interactions with both parents.

Whereas book reading was more exclusively tutorial in the naming of pictures, the computer format elicited more knowledge-elaborating comments and directives for how to operate the computer. The computer elicited less verbalization overall, but cycles of conversation about particular topics were significantly longer. Thus the computer is not just a video version of a book. The kinds of interactions that occur with a computer can result in different kinds of learning. Future research will help distinguish between intrinsic differences in the media and effects due to software or familiarity. None of our subjects had had much experience with a personal computer before

(and none had seen the "My First Alphabet" game), whereas all had previously read alphabet books. Since personal computers are just beginning to gain wide consumer acceptance, it was not possible to recruit a subject pool of "computer literate" three-year-olds for this study. A remedy for the novelty problem would be to observe subjects repeatedly, a costly and time-consuming procedure. In the future it will be important to discover whether differences between computer and reading interactions persist after subjects have had repeated experience with the computer program.

A number of suggestions for improving alphabet software come to mind as a result of this study. First, the speed of presentation seems to be slower than parents and children prefer to "read" pictures in books. Items could be drawn faster, or participants could be given a choice of speeds. Having several possible exemplars for each letter would make the activity less tedious to parents, as children have a tendency to push the same key repeatedly. Lower-case letters, more important for reading than upper-case letters, should be featured. Parents could be prompted (or a speech synthesizer could be employed) to ask children to pronounce the sounds of the letters. Although sound pronunciation is an important antecedent to the grapheme-phoneme decoding required in reading (Mason, 1980), parents tend to request children to give the letter names rather than the letter sounds (Price, 1984). An especially intriguing idea is to have the computer present integrated picture mnemonics of the type developed by Ehri, Deffner, and Wilce (1984). The sound of the letter is linked to to its shape by incorporating the letter right into the picture mnemonic. Examples include a lamp with an "l" for its stem, a v-shaped vase, and a droopy flower in the shape of an "f". Ehri et al. (1984) found such pictures to be especially effective for helping preschoolers remember the sounds associated with particular letters. Finally,

both the books and the computer contained several inappropriate examples. One book depicted an armadillo-like rodent, a "xenuris", for the letter X. Children had particular difficulty with the computer-generated outline of the United States, as "map", for the letter M. The jeep for the letter J was almost always labeled a "car" by the children. A small gorilla for the letter G was called "Donkey" by a number of children, presumably because of its resemblance to Donkey Kong. Software developers (and picture-book authors) should pretest their exemplars to assure appropriateness for the developmental level of the intended audience.

Mothers vs fathers. In general, our findings replicate previous research showing few differences in the way fathers and mothers interact with their preschoolers, and extend this conclusion to include the tasks of joint picture-book reading and computer pre-reading activities. Differences found for mothers vs. fathers were usually in the children's reactions to them, rather than in their own behavior per se. Only when interacting with their mothers did children alter certain verbal behaviors (identifications, extraneous references, comments and directives) in the two tasks. Children's responses to questions also varied in complex ways as a function of sex of parent and task. In general, though, effects of task outweighed differences in the way parents interacted with their preschoolers. We certainly did not observe Masur and Gleason's (1980) finding that fathers were superior in communicating complex information to their preschoolers. We agree with their speculation that the traditionally masculine nature of the toy car used in their study may have afforded an advantage to fathers. There was no evidence in our study, however, that the computer format is somehow generically masculine; fathers and mothers did not differ in their interactions with the computer, nor were there any differences for boys vs. girls.

However, there was one area of dramatic difference between the two parents. Mothers were remarkably consistent in their verbal styles across the two tasks, and fathers were not. The mothers' consistency was found for verbal categories expressing labeling and naming, as well as elaboration and comprehension-fostering, feedback, and attention-directing. The fathers' consistency was restricted to the direct teaching categories of identifications and requests for identifications (and laughter). This finding of differences in consistency of style across two tasks has not been previously reported in the literature, perhaps because researchers have not usually looked for it (and few studies have compared mothers and fathers across more than one task).

In conclusion, our research has examined the similarities and differences in parent-child interaction with the traditional medium of book reading in contrast with the new educational tool of the personal computer. Documenting the nature of these interactions is pertinent to understanding the precursors of children's future educational success. Whereas parent-child book reading activity has been previously studied (although with mothers only), our project provides the first detailed examination of parent-child interactions with home computer software for preschoolers. Because computers are becoming a widely available learning tool in the schools, and are entering the home at a rapid rate, additional investigations of the nature of parent-child preschool computer learning are inevitable.

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Table 1

Categories of Verbal Behaviors

General Category	Specific Category	Definition	Example
Naming and labeling	Request for identification	Asks for a name or label for a pictured item	What is that? Do you know what that one's called?
	Identification	Gives a label for a pictured item	A is for apple Donkey Kong
Elaborating, comprehension fostering	Comment	Remark about a present object, picture, or event	That starts your name. I think we saw this one before.
	Question	A query about anything except a request for an identification	Did we do this one? Is he scary? How did the horse get up on that house?
	Extraneous reference	Remark about a past or outside event or object	I saw the billy goat at my school. We've seen these at Sea World, too.

Table 1, continued

Feedback	Positive remark	Affirmation	Yes, umhum
	Negative remark	Negation	No, don't
Attention-directing, exclamatory	Directive	An imperative	Push another key now.
	Personal reference	Use of partner's name or other personal identification	Mommy Daddy Honey Buster
	Laughter	Laughter	Laughter

Table 2

Parents:

Proportion of Verbal Events as a Function of Task and Category

Verbal Category	Task: Book		Task: Computer	Mean
Requests for identification	.25		.19	$.22_{a}$
Identifications	.24	*	.18	$.21_{a}$
Comments	.13	*	.17	$.15_{ab}$
Positive remarks	.14		.15	$.14_{ab}$
Directives	.07	*	.15	$.11_{bcd}$
Questions	.09		.08	$.09_{bcd}$
Negative remarks	.03		.05	$.04_{cd}$
Extraneous references	.02	*	.01	$.02_{d}$
Name, personal references	.01		.02	$.01_{d}$
Laughter	.01		.01	$.01_{d}$

Note: Significant differences in rows for particular book vs. computer comparisons are indicated by *. For category effects, column means that do not share subscripts differ from one another significantly at the $p < .05$ level (Newman-Keuls test).

Table 3

Children:

Proportion of Verbal Events as a Function of

Task, Category, and Sex of Parent

Verbal Category	Mothers			Fathers		Mean
	Book		Computer	Book	Computer	
Identifications	.57	*	.43	.47	.48	$.48_a$
Comments	.17	*	.26	.23	.22	$.22_b$
Positive remarks	.06		.06	.10	.09	$.08_c$
Questions	.04	*	.09	.05	.05	$.06_c$
Requests for identification	.06		.04	.04	.07	$.05_c$
Negative remarks	.03		.03	.05	.03	$.04_c$
Directives	.02		.04	.03	.03	$.03_c$
Laughter	.03		.02	.01	.01	$.02_c$
Name, personal reference	.02		.02	.00	.00	$.01_c$
Extraneous references	.01		.01	.01	.01	$.01_c$

Note: Significant differences in rows for particular book vs. computer comparisons are indicated by *. For category effects, column means that do not share subscripts differ from one another significantly at the $p < .05$ level (Newman-Keuls test).

Table 4

Verbal Behaviors: Correlations between the book-reading and computer tasks

Verbal	Parents		Children with	
Category	Mothers	Fathers	Mothers	Fathers
Identifications	.942*	.869*	.450	.519
Requests for identification	.599	.813*	.225	.387
Directives	.834*	.493	.131	.309
Comments	.751*	.231	.243	.012
Questions	.795*	.160	.262	.515
Negative remarks	.872*	.345	.692*	.035
Extraneous references	.755*	.442	.127	-.081
Positive remarks	.301	-.093	.255	.350
Name, personal reference	.528	-.000	.153	-.111
Laughter	.814*	.832*	.735*	.840*

Note: *p = .05 for r = .632

Table 5

Looking Duration

Task	Book	Screen	Keyboard	Other Person	Away
Book	78.02%			13.73%	8.24%
Computer		66.83%	22.97%	6.50%	3.70%